



Subwavelength terahertz imaging with graphene hyperlens

Andryieuski, Andrei; Lavrinenko, Andrei

Published in:

The 12th International Conference of Near-field Optics, Nanophotonics and Related Techniques

Publication date:

2012

Document Version

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Andryieuski, A., & Lavrinenko, A. (2012). Subwavelength terahertz imaging with graphene hyperlens. In *The 12th International Conference of Near-field Optics, Nanophotonics and Related Techniques* (pp. 30)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Subwavelength terahertz imaging with graphene hyperlens

A. Andryieuski, and A.V. Lavrinenko

DTU Fotonik, Ørstedes Plads 343, Kongens Lyngby, Denmark
andra@fotonik.dtu.dk

The terahertz (THz) technology provides with striking possibilities for defense, spectroscopy and biomedical imaging [1]. However, a large wavelength ($\lambda > 10 \mu\text{m}$) does not allow resolving tiny details. One of the solutions is a lens consisting of a material with the hyperbolic dispersion (hyperlens) [2]. Direct scaling of optical designs to the THz range is not possible, since metal's negative permittivity becomes too large in absolute value. This is why the employment of new materials is required.

In this contribution we report for the first time the graphene wire medium based hyperlens. Stacking multiple structured graphene layers provides the hyperbolic dispersion. To restore the graphene wire medium dispersion diagrams and isofrequency contours we developed a rigorous numerical method. It also gives the possibility to calculate the permittivity tensor and to check the applicability of the homogeneous medium approach.

Our numerical simulations in COMSOL and CST Microwave Studio confirm the subwavelength imaging properties of the graphene hyperlens. An example of magnification of two point sources separated by $\lambda/5$ to the size of few wavelength, which then can be detected with conventional optics, at frequency $f = 6 \text{ THz}$ ($\lambda = 50 \mu\text{m}$) is shown in the **Fig. 1**. The details of the graphene hyperlens design as well as the dispersion diagram calculation method will be provided during the presentation.

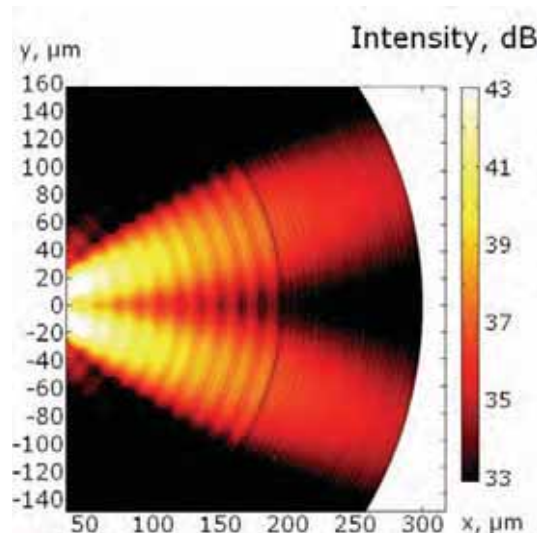


Fig. 1: Graphene hyperlens in action. Two point sources separated by $\lambda/5 = 10 \mu\text{m}$ are magnified to the distance of a few wavelengths.

- [1] P. U. Jepsen, D. G. Cooke, and M. Koch, *Laser & Photon. Rev.* **5**, 124-166 (2011).
- [2] Z. Jacob, L. V. Alekseyev, and E. Narimanov, *Opt. Express* **14**, 8247-56 (2006).